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ABSTRACT

The first of this series of studies on the ability of young children to follow directions was designed to find out which is easier for a preschool child: to follow directions given only by demonstration or given only verbally. Subjects were 108 white, middle class, 4-year-olds enrolled in a nursery school. Each teacher tested the children in her class to determine their understanding of relational words and their ability to follow individual directions. Study results showed no significant difference between scores of children asked to follow a verbal command and those asked to follow directions given by demonstration. A second study investigated children's ability to follow either novel or additive sequential directions. There were 30 children in each group. It was found that children could handle significantly more directions in the additive condition than in the novel. A replication-extension of this study (40 subjects) showed that use of incentive did not increase the number of directions remembered. In another study, conditional directions scaled from easy to difficult were used and more than one-half the subjects successfully completed all of the conditional directions. A map study involving the need to follow symbolic code directions showed that children were able to use the code when the transfer of the code to the real life environment was fairly obvious. (NH)

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The Preschool Child's Ability to Follow Directions[1,2,3]

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The work reported in this paper is a series of studies concerned with the preschool child's ability to follow directions. It is the general consensus of opinion among teachers that a prerequisite for success in school is the ability to follow directions. Tying a shoe, standing in line, coloring in the right picture in a workbook and solving an arithmetic problem are all based on being able to follow some direction or series of directions. Following directions is implicit in almost any study of children's learning or children's cognitive abilities. In order to succeed at any laboratory type task the child must be able to follow directions. Yet the kinds of directions preschoolers can follow and variables affecting this have not been studied per se.

One might argue that following directions is too all encompassing a rubric, that it does not differ from aspects of imitation, verbal learning or cognitive development. To be sure, direction following may relate to all of these areas. But we cannot say that all imitation involves following directions even if following a demonstration involves imitation. The purpose of our investigation is to explore the development of the ability to receive a command from another person and follow through on the command. I have then limited my investigation to situations where the person is asked, in one way or another, to do a specific thing at a specific time.

Directions may be given in several different ways:

1. By demonstration of the process: tying a bow, doing a cartwheel.
2. By verbally denoting the parts and steps involved in the process: "walk to your locker," make a bridge of only red blocks."
3. Combining demonstration and verbalization: "See this watch can be fastened by putting this end in the hole and pushing this latch over there."

4. Using pictures to denote the steps involved to reach an endpoint: for example, the diagrams with a box of Tinker Toys or a Lego set.
5. And using symbols or written words to convey the process: "Go directly to jail; do not pass Go, do not collect $200," as on the card in the Monopoly game.

Last year my husband and I put together a Heath Kit FM Stereo tuner. The Heath Kit Company bends over backwards to make sure that the purchaser, without any previous experience can assemble and solder this intricate piece of electronic equipment and within 20 hours of assembling time plug in his tuner and have FM music in Stereo. They include a step by step manual on the soldering process, with pictures of how to hold the soldering iron, descriptions of the process and photographs of good and poor soldering. Every component part is color coded, numbered, shown individually in a drawing and shown in place in the circuit board. And the assembler is provided with a step by step detailed description of where to put each piece and how to do it. He is even provided with space to check off each item after the step is completed. (The only problem we had was that somehow we managed to skip two pages in the manual and only when we were disastrously close to the finish did we begin to worry about all the extra diodes and resistors we still had, and discovered our mistake.)

But what kind of skills are involved in following all these directions? What learning was necessary for carrying out this elaborate process? Many factors are involved in a person's being able to follow a direction. First, he must be physically capable of carrying out the act. Then if the direction is given verbally he must understand what each word means and have some comprehension of what the words mean in this context. For example, if I say "make a circle" to a group of 3-year-olds who know what a drawn

circle on paper is but have not experienced forming a circle by joining hands as a group, I will produce mass confusion. Following directions also involves combining ideas of elements, such as "do a backward somersault" when the person knows what backwards and somersault mean. Another factor involved would be the person's comprehension of order; if the direction were to "first do this, then that, third this, etc." Finally the child or adult must be able to discriminate situations when it would be appropriate or inappropriate to carry out the direction: e.g. "in case of fire break this glass and pull the lever."

Presumably the child first learns to follow a direction by imitating a parent or adult doing a motor act such as waving bye-bye. The acts are sometimes paired with verbalizations such as saying "So big" and raising the arms. Probably the child learns to monitor his activity on the basis of gestures and demonstrations from others, and at the same time verbal directions are probably paired with the demonstration. Gradually the demonstrations or gestures can be omitted and as the child builds his vocabulary he can monitor more of his actions on the basis of verbal directions. And at some point he learns the meaning of symbols and words and can translate this into motor activities. As yet we can only speculate about when the child learns to follow a demonstration, verbal command and then symbolic directions.

Bruner (1966) has described the child as moving from ikonic imagery to symbolic imagery in his thinking. Thus according to Bruner the young child is capable of performing acts or following a series of actions with real objects because only the real objects evoke an image in the child's mind. Only later can a child follow or monitor his activity on the basis of symbols or words, when he no longer needs to rely on the concrete objects in his thinking.

Corsini (1969) has done some recent work on ikonic vs. symbolic imagery in children's ability to remember directions. He presented preschool and second grade Ss with several tasks involving directions. The directions were presented either verbally or verbally with manipulation of the real objects. He also presented the directions non-verbally, simply by demonstrating. His results were that the preschoolers performed the best when the directions were given verbally with demonstration. The 2nd graders, however, did just as well when the directions were given only verbally.

In the series of studies reported here the first question investigated was whether it is easier for the preschool child to follow directions given only by demonstration or only verbally. The hypothesis was that it is more difficult for a 4-year-old to monitor his activity on the basis of verbal commands than to observe an adult demonstrating the same actions and then imitate the action. The Ss used were 108 white middle-class 4-year-olds enrolled in the Liverpool Laboratory Nursery School, Syracuse, New York. All the testing was done by teachers, each teacher testing the children in her class.

In planning the study, we tried to make certain that the Ss understood the meaning of all the words involved in the directions. Each child was first tested on his understanding of 18 prepositions or relational words. He was shown several well known objects and asked to combine two objects, like "Put the cup on the napkin," "put the cup under the table." In no instances did the Ss choose the wrong objects. Ss were tested on their understanding of the following words: on, next to, between, around, behind, in, through, across, beside, above, on the outside of, in the middle of, below, inside, over, near, on top of, and under. Approximately 95% of the children had no difficulty with the directions with the exception of three prepositions. Below, above, and behind were missed by approximately 60%

of the Ss. In testing a second group of children on the same concepts it appeared that the difficulty with the word "behind" seemed to depend on whether or not the object had a definite back side. Thus, the Ss could not place a button behind a cup, but could all stand behind the teacher.

Next the Ss were given 17 individual directions to follow, involving items familiar to all the children. Each direction was presented either verbally or by demonstration and then the child was asked to do what the tester said or what she did. The activities presented were somewhat unusual actions, possible but not often done by the child, thus not already habitual to the child. An example was "sweep the wall," or "sit on your hands."

Our purpose was to test whether a child could combine elements known to him in another context but not necessarily familiar in this new context. The results of the study indicated that there was no significant difference between scores of Ss asked to follow a verbal command and those asked to follow a demonstration. About the same number of tasks, about 93%, were passed in either condition. This finding is at variance with the result reported by Corsini (1969).

It may be that all our directions were too easy for these children. At present a graduate student and I are working with 4-year-olds to try to scale kinds of activities which are easier to learn when directions are given verbally (perhaps like a sorting task) and activities easier to accomplish after a demonstration (like playing hopscotch). It may be that at a certain developmental level it is easier to follow a demonstration than a verbal direction. But as yet we have little evidence that, if the child knows the meaning of the words involved, that it is more difficult for him to accomplish a direction given verbally.

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Another approach to studying a child's ability to follow directions is to analyze component parts of a direction rather than the way it is presented.

In describing kinds of directions according to the component parts I have come up with the following classifications:

1) One word directions--e.g., Stop, Go, Turn, Kick.
2) Simple directions--a direction involving only one action but more than one word. "Look at the window" or "raise your hand."
3) Simultaneous directions--asking the person to do two or more things at the same moment. E.G., "While stirring constantly add the sugar," or "Pat your head while you rub your stomach."
4) Sequential directions--involving a series of activities, either done in a specific order or in undetermined order. These directions would not be carried out simultaneously.
5) Conditional directions--directions which specify the conditions under which to carry out one or more actions. An example would be "If the light turns red, you stop." A conditional direction may involve more than one condition and more than one action.

There can also, obviously, be various combinations of these five kinds of directions, and they can be given in different ways; in print, verbally, etc. There seems to be little question (in my mind) that if the preschool child really knows the meaning of the words and is physically capable that he can follow simple and one word directions.

But what about sequential directions? The second study dealt with this question. Two kinds of sequential directions were determined. In a Novel series of sequential directions the S is asked first to do one activity like "clap your hands." Then he is asked to follow two directions,

both different from the first, like "put the cup on the napkin and then touch your nose." He is then told three entirely new directions, then four, and so on. In an Additive series of directions the S is given first one direction, the two, the second being the only new direction. An example of this would be "Clap your hands. Okay now clap your hands and put the cup on the napkin. Now clap your hands, put the cup on the napkin, and then touch your nose." After each sequence the S is asked to follow a larger sequence, but with only one new direction.

We designed one procedure that intuitively would give children the most help. We wanted to see how many directions a 4-year-old could remember and follow in this maximizing procedure of Additive sequences. The second procedure, the Novel, was set up to determine how many directions a child could follow when all directions given at one time were new. This method involved working the child up to a maximum number of directions. It is possible that this Novel procedure may have led to a low estimate of the child's ability to remember a series. In other words, by the time the S was given a series of six new directions he had already been asked to do 15 things. But this approach was taken rather than testing out an arbitrary number of new directions because the child might not perform adequately if not given a warm up period.

In a study done last year at the Liverpool Laboratory Nursery School, 30 4-year-olds were tested on the Novel Sequential directions and 30 children tested on the Additive Sequential Directions. Again the Ss were tested by their own classroom teacher. Our purpose was to see how long a series of directions these children could handle under the two conditions. We encountered several difficulties. One was that the teachers differed in their

definition of how far to push the child in remembering a series. Thus some teachers stopped when the child forgot two directions, and some kept going until the child could only remember one or no directions. The second problem was that some of the directions in the series were distracting or took longer to complete. An example was "Tear the napkin" which in many children triggered off a complete shredding of the napkin and a forgetting of the rest of the items. The general finding was, however, that the Ss could handle significantly more directions in the Additive condition than in the Novel, and that the children could remember many more directions than we had expected; up to 6 in the Novel and 11 in the Additive.

In a replication-extension of the study this Fall, the factors investigated were, given a series of comparable, non-distracting directions would Ss remember significantly more directions under the Additive condition than the Novel condition, and would the use of an incentive enhance the number of directions remembered by each group.

Forty 4-year-olds were tested by a graduate student and me. Ten Ss were tested in each of the four conditions: 1) Novel--nonreinforcement, 2) Novel--reinforcement, 3) Additive--nonreinforcement, and 4) Additive--reinforcement. In previous pilot work items in the series had been tried out on other children to see if they could do each simple direction. All directions involved words the children knew and all seemed to be comparable, in that all the pilot Ss could do the individual items. The same directions were given to each test group in either a Novel format or an Additive format. In the Novel conditions the E went only as far as 6 items in the series. In the Additive conditions the E stopped after asking the child to remember a series of ten directions. The cut-off points were determined on the basis of the previous study at the approximate upward limit of the children.

In the reinforcement conditions the child was told that for each thing he could remember to do he would be given a raisin. And after each trial the S was given the number of raisins equivalent to the number of directions he had followed. The reinforcement was stressed before each trial by the E saying "I'm going to ask you to do five things. Try to get all five raisins."

In the nonreinforcement conditions the child was simply told that he would get some raisins at the end to take home. A record of how many items the child could remember in each series was kept, as well as the order in which he performed the actions.

A between Ss analysis of variance was performed on the first six trials in all conditions to see whether the reward did enhance performance and to test for an interaction between reinforcement and Additive vs. Novel condition. The analysis indicated, as expected, that both the Additive groups could remember significantly more directions than the Novel groups ($p < .05$). Thus not only could the Ss in the Additive Group go higher in a series of directions, but also, given a series of four or five directions, they remembered significantly more items. There was, however, no difference between groups receiving reinforcement and those not, and no interaction. Ss in the Novel-Reinforcement group tended to do somewhat better than those in the Novel-Nonreinforcement groups, but the trend was not found in the Additive conditions. The graph of per cent correct responses in each trial for each condition indicates the difference between the two groups.

Figure 1 about here

It should be mentioned that the order of the directions was difficult for the Ss. Even though the tester stressed doing the directions in the

order they were mentioned, few understood what this involved or could remember. Several Ss tried to do all the actions at the same time.

If then, a preschooler can remember and perform a series of directions, what about an intuitively more difficult problem, the conditional direction? Obviously, the child has learned conditions for certain actions, like crying, but if he is told once or twice what to do given a certain condition, how well can he perform? In the third study an attempt was made to scale conditional directions along an easy to difficult dimension as determined by several factors.

As mentioned previously conditional directions involve instances when a person is told the conditions or the level which should trigger or be followed by a particular action. Thus the two parts involved in a conditional direction are a signal or specified condition and the action. In the direction "If I clap you stand up," the signal is a clap and the action is stand up. But other factors will influence the difficulty of a given conditional direction. The nature of the signal is one important factor. There are certain signs or signals which are easily recognized as a signal. A flashing light, a clap, a whistly, the word "Go" are often used to indicate that some different event or activity is about to or should take place. But in the direction "If I say Mashed Potatoes you put your head down," mashed potatoes is an unexpected signal. Perhaps even more difficult are instances when a familiar signal is used but the action to follow is the opposite of the signal word's meaning. An example of this would be the direction "If I say Stop, you jump up and down."

Another factor influencing the difficulty of the Conditional direction is the length of time between when the direction is given and when the signal is heard or seen, and if two conditional directions are given at the same

time. The nature of the activity as well as the length of time it takes to complete one action may influence how well a child remembers the second condition.

Six directions (see Table 1) were devised. The hypothesis was that these six differed in difficulty, the first being the easiest and the last the most difficult, for previously mentioned reasons. The Table indicates the directions given and the order in which the signal was then given to the child. The order in which the two signals were given was varied so the child did not simply do the first action first but had to wait for the signal. All the testing was done by the teachers and all errors were described in detail. It is the analysis of the errors that is the most interesting.

Table 1 about here

First, 94% of the Ss could follow the simple conditional directions, items #1 and #2. The Ss missing these items did not wait for the signal but carried out the action immediately. Only 9% missed item #3. In this instance the Ss making errors confused the colors of the objects used. Each E had made certain that all Ss could discriminate the colors but apparently these Ss confused which color belonged with which signal.

The next three items were more difficult; one third of the Ss making errors on items #4 and #5 and 50% of the Ss erring; on item #6. The number of errors made were fairly equally divided between three types of errors: 1) Reversing the color of the bead, 2) reversing the actions done to the particular signal, and 3) forgetting the action or doing the signal rather than the action. Thus item #6 was the most difficult because the child was presented with a direction containing signals which contradicted the action, and involved actions which took longer to complete.

What is the most interesting to me was the number of children who had no difficulty with these conditional directions. More than one-half of the Ss tested were able to successfully follow and complete all the conditional directions, far more than I had originally expected.

The other interesting observation was that several of the Ss rehearsed the directions and were successful in completing them. In a further study it would be fruitful perhaps to encourage one group of Ss to repeat or rehearse the directions before receiving the signal.

I have presented several studies concerning direction following and tried to delineate components of directions and ways in which they are presented. I have not mentioned following symbolic directions as opposed to verbal. My husband and I have been working on map reading with 4-year-olds but time will not allow me to describe these studies in detail. A general summary will suffice. A map represents a symbolic direction since the task for the map reader is to find a particular place or arrive at a certain destination by referring to a schema or plan. The map reader must understand how things are coded on the map and then make the mental transfer from the code to space and items in his environment. In our work we were interested in whether a preschooler could understand what a simple map meant and if so how well could he use it.

In one study a three dimensional miniature mock-up of the classroom was presented to the child. Pictures of the identifying aspects of the room, like lockers, tables, etc. were pasted in the mock-up. The child was asked to go to a particular spot pointed out by the tester and in general could do this with little trouble. Yet the mock-up seemed to be meaningful

to them only when it was in exactly the same orientation as the room. Thus the children did not understand or could not use the symbolic representation of the map well enough to say to himself, this little room is turned around so I must turn it so that the windows and door are in the same directions.

In a second study Ss were presented with a simple Y maze through which they were to run their finger to get a poker chip concealed at the end of the correct prong. A map of the same maze was colored so that the poker chip was always hidden at the end of the prong colored red. He was shown a series of maps on which the position of the red prong was varied. Again the Ss had little difficulty using the map when it was right side up. But, like with the mock-up, the Ss could not use the map when it was rotated 180^{o} and failed at the task.

The results of these two studies seem to indicate that the child can make use of such a symbolic code when the transfer to the real life environment is fairly obvious. Yet when the transfer is not obvious the problem becomes much more difficult. Thus even though the children knew that the map represented the room or the maze they could not figure out that you need to turn the map to be able to use it. Again this data seems to indicate that a child can follow a symbolic direction in one context but may not be able to use the direction in another context.

In the work reported here I have suggested that preschoolers were quite capable of following a variety of directions. We need then to research further the question of what directions they cannot follow and why. One obvious reason would be lack of familiarity with the words involved, but even if the child does know one meaning of the words involved, can he apply this knowledge to another situation and if not, why.

Another interesting approach would be to teach a child the meaning of a new word, a nonsense word he has never heard in a direction before, and ask him to combine it in a new direction. An example of this would be to teach the child to mugwump a block, mugwump meaning turn it around three times, and then ask him to mugwump the pencil.

Some children may not be able to follow other directions because they cannot inhibit long enough to receive the information and produce the action. It would be fruitful then to compare impulsive with less impulsive children on their ability to follow directions.

I have also indicated that memory is an extremely important dimension. We need then, to look further at what factors enhance memory of actions or behaviors. One approach mentioned would be to help the children rehearse the commands before following through. And the question is still unanswered as to how feasible it is to teach a pre-reading child to follow symbolic directions. Perhaps when I have looked into some of these questions I will try my class of 4-year-olds out on a Heath Kit color television set.

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Footnotes

1. This research was performed pursuant to a contract with the Office of Education, U.S. Department of Health, Education, and Welfare through the Syracuse Center for Research and Development in Early Childhood Education, a component of the National Laboratory on Early Childhood Education. Contractors undertaking such work under Government sponsorship are encouraged to express freely their professional judgment in the conduct of the work. Points of view or opinions stated do not, therefore, necessarily represent official Office of Education position or policy.
2. The author wishes to express her appreciation to the staff of the Liverpool Laboratory Nursery School for their help and advice in conducting this research.
3. This paper was presented at the annual meeting of the National Association for the Education of Young Children, Salt Lake City, Utah, November, 1969.

Table 1

Direction	Order for Signal
1. If I clap, you clap.	Second (hum first)
2. If I whistle, you pick up the red bead.	First
3. If I whistle, pick up the blue bead; if I clap you pick up the red bead.	Clap first, whistle second.
4. If I snap my fingers, you stand up; if I scratch my nose, you put the red bead on your foot.	Snap first, scratch
5. If I say (child's name), you roll the blue bead down the hall; if I say 'Mashed Potatoes', put the red bead next to the wall.	Name first, Mashed Potatoes second.
6. If I say 'Hold still', you jump up and down, if I say Stop, put the red bead next to the door to the playground.	Stop first, Hold still second.

Figure 1

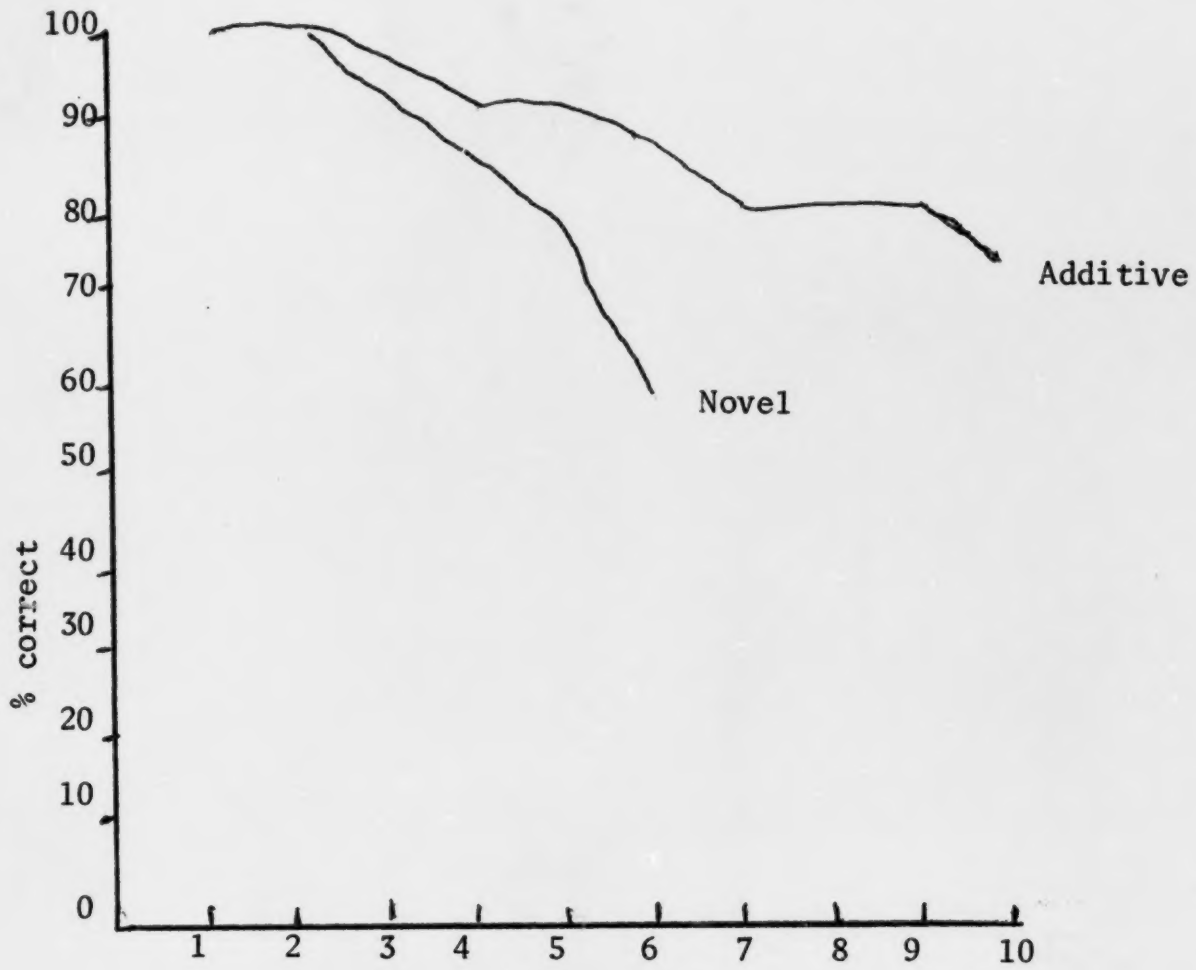

Figure Caption

Figure 1. Per cent correct responses per trial of Ss in Additive and Novel conditions.